

4. Guozhi

Program Name: Guozhi.java

Input File: guozhi.dat

After the heist (*as described in Terry's story later in the packet*) Terry passes the stolen contraband to Guozhi to be smuggled out of the city. He needs some help from you and your team to accomplish this dangerous task. Can you help Guozhi find a way to the safe house without getting caught?

The city can be modeled as a grid with R rows and C columns. Some cells in the grid have trees, and others have cameras. Guozhi cannot enter a cell with a tree or camera.

During each time-unit, the cameras rotate clockwise by 90 degrees. That is, if the camera was looking in a certain direction in one time-unit, it would be looking to the right of that direction in the next time-unit. Cameras can see every cell in a straight line from the camera in the direction it is facing but cannot see through trees or the safe house. Cameras can see through other cameras in their current line of sight. Fortunately, the team's tech guy has provided Guozhi with a special computing device that can sense the current state of each camera so he can safely contemplate his next move.

At the start of each time-unit T, if there is a camera that can see Guozhi, he gets caught. Otherwise, the cameras all rotate 90 degrees clockwise each time-unit, and Guozhi can opt to either stay still or move to an adjacent empty cell. Two cells are adjacent if they have a side in common. How fast can Guozhi get to the safe house?

DISCLAIMER: The University Interscholastic League does not endorse using computing skills for breaking the law or other evil misdeeds.

Input: The first line of input is an integer T ($1 \leq T \leq 20$), the number of test cases. Each test case begins with two integers R and C ($1 \leq R * C \leq 1,000$), the number of rows and number of columns. The next R lines each have C characters, which are one of the following 8 characters:

G - the starting location of Guozhi
H - the location of the safe-house
E - A camera which is facing east at time $T = 0$
N - A camera which is facing north at time $T = 0$
S - A camera which is facing south at time $T = 0$
W - A camera which is facing west at time $T = 0$
· - an empty square
- a tree.

Output: For each test case, if it's impossible to escape, output -1. Otherwise, output the minimum amount of time to get to the safe house. Format your output with the case number as in the samples.

Samples and explanation on next page.

Guozhi sample input:

```
3
3 3
..G
N..
..H
3 3
..H
N#.
..G
4 5
.###H
S....
.G###
#..N#
```

Sample output:

```
Case #1: 3
Case #2: 2
Case #3: -1
```

Sample explanation:

In the first sample, Guozhi cannot immediately move south because the camera would catch him at the beginning of time $T = 1$. The optimal strategy is to wait in the starting cell for 1 time-unit, and then move south twice. This takes 3 total time units.

In the second sample, a tree blocks the camera so Guozhi can just move north twice.

In the third sample, there is no way to get to the exit without being seen by the leftmost camera.